Insider Trading and Financing Constraints

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Abstract

Insider trading may alleviate financing constraints by conveying value-relevant information to the market (the information effect) or may exacerbate financing constraints by impairing market liquidity and distorting insiders' incentives to disclose value-relevant information (the confidence effect). We examine the significance of these two contrasting effects by investigating the link between insider trading and financing constraints as measured by the investment-cash flow sensitivity. We find that, overall insider trading exacerbates financing constraints; however the information effect dominates the confidence effect for insider purchases. Only trades by executive directors are significantly related to financing constraints.

Keywords: Insider trading; investment-cash flow sensitivity; financing constraints; information hierarchy hypothesis
JEL classification: G1, G3

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1. Introduction

It is widely accepted that corporate insiders trade in the shares of their firms on the basis of their informational advantage over outside investors (Seyhun, 1986; Fishman and Haggerty, 1992; Piotroski and Roulstone, 2005). We examine the impact of insider trading[1] on corporate financing constraints, which are likely to arise when information asymmetries and/or agency problems impede firms' ability to raise external capital and, consequently, make their investments sensitive to the availability of internal funds (Fazzari, Hubbard, and Petersen, 1988; Hadlock, 1998; Cleary, Povell, and Raith, 2007).

Theoretically, insider trading is likely to have two contrasting effects on corporate financing constraints. On the one hand, insider trading may convey insiders' private information to outside investors (Seyhun, 1986; Lakonishok and Lee, 2001; Fidrmuc, Goergen and Renneboog, 2006) and may act as a credible signal to the market about the value relevance of various corporate events, such as dividend policy and investment expenditure (John and Lang, 1991; Damodaran and Liu, 1993). This 'information effect' of insider trading may improve the allocation of capital by enabling outside investors to make more informative assessments of the value of firms' investment projects (Leland, 1992; Manne, 2005). Consequently, insider trading, via the information effect, may alleviate financing constraints that arise due to the presence of information asymmetries in the market.

On the other hand, corporate insiders' ability to gain from insider trading may induce them to manipulate/delay value-relevant information to maintain their informational advantage over outside investors (Narayannan, 2000; Cheng and Lo, 2006) and may encourage them to undertake projects that are not compatible with the shareholder value maximisation principle (Bebchuk and Fershtman, 1994). From this perspective, insider trading may reduce outside investors' confidence

[1] Strictly speaking, insider trading refers to trading on the basis of private information that is not available to other market participants. Such information-based trading is not restricted to corporate insiders. However, most empirical studies on insider trading focus on the trades of executive and non-executive directors while a few studies also examine trades of large shareholders. UK regulation on insider trading also defines insiders as executives and non-executives. Hence, following the extant empirical literature on insider trading, we focus on directors and use the terms directors and insiders interchangeably. Finally and in line with UK regulation, we use the term 'insider trading' to refer to trading by the directors.

in the firm's projects by making them more skeptical about insiders' motives and about the information that is available in the market (Manove, 1989; Ausubel, 1990; Giammarino, Heinkel, and Hollifield, 1994). This 'confidence effect' of insider trading may reduce investors' willingness to provide capital to firms with a high incidence of insider trading and, consequently, increase these firms' reliance on the availability of internal funds to finance their investments.

Given the contrasting effects of insider trading on financing constraints, the question arises as to whether just one of these effects exists or whether they both exist. If the latter is the case, the question arises as to which one dominates. We address these questions by proposing and testing hypotheses regarding a potential link between insider trading and financing constraints as evidenced by the investment-cash flow sensitivity. Our analysis, based on an unbalanced panel of data for UK listed companies during 1995 and 2011, suggests that firms without insider trading exhibit lower investment-cash flow sensitivity than firms with insider trading. However, when we distinguish between insider purchases and sales, we find that the former reduce the investment-cash flow sensitivity, while the latter increase it.

Our analysis contributes to the academic literature and policy debate on insider trading in two major ways. First, unlike the majority of studies that focus on the market reaction to insider trades and on related insider gains, our findings on the link between insider trading and the investment-cash flow sensitivity add to the burgeoning empirical literature on the impact of insider trading on corporate financial policies (Malmendier and Tate, 2005; Chen, Goldstein and Jiang, 2007). Second, given the substantial debate among policy makers on whether and how to restrict insider trading (Bainbridge, 2001; Read, 2009), our evidence that insider purchases alleviate financing constraints provides support to the argument that trading by corporate insiders may not always have an adverse impact on the allocation of capital to firms (Manne, 2005; Bebchuk and Fershtman, 1994).

2. Insider trading and investment-cash flow sensitivity

Ever since the seminal work of Fazzari, Hubbard and Petersen (1988), a large number of studies show a significantly positive relationship between corporate investment and cash flow. It is usually argued that positive investment-cash flow sensitivity indicates corporate financing constraints due to market imperfections that make external capital more expensive than internal capital and, consequently, increase firms' reliance on internal funds to finance their investments (Hadlock, 1998; Goergen and Renneboog, 2001; Cleary, Povell, and Raith, 2007). For example, outside investors may only provide capital at a very high cost because information asymmetries inhibit their ability to assess the true value of firms' investment projects (Greenwald, Stiglitz and Weiss, 1984; Myers and Majluf, 1984). Alternatively, due to a misalignment of managerial interests with those of the outside investors (Jensen, 1986), self-interested managers may overinvest internal funds because, from their perspective, these funds are 'too inexpensive' (Hadlock, 1998; p. 488). Given this literature on the significance of information asymmetries and agency problems in creating a wedge between the cost of internal and external capital, we examine whether insider trading affects financing constraints as measured by the investment-cash flow sensitivity.

However, there is substantial controversy in the literature regarding the validity of the investment-cash flow sensitivity as a measure of financing constraints. For example, based on detailed information from annual (10-K) reports and from managers' discussions on the uses and sources of funds for a small sample of US firms, Kaplan and Zingales (1997) find that firms that are more financially constrained have *lower* investment-cash flow sensitivity than firms that are less financially constrained. Similar findings are reported in Cleary (1999) who classifies a large sample of US firms into financially constrained and unconstrained firms using multiple discriminant analysis. Kaplan and Zingales (1997) and Cleary (1999) challenge the argument that there is a monotonically increasing relationship between investment and cash flow.

The more recent literature seeks to examine the possibility of a non-monotonic relationship between investment and cash flow. Allayannis and Mozumdar (2004) find that the measured

difference in the investment-cash flow sensitivity of financially constrained and that of unconstrained firms depends on whether firms with negative cash flow are included in the sample. Their results confirm Fazzari, Hubbard and Petersen's (1988) proposition that the availability of internal funds determines the extent of investment. However, they also find support for Kaplan and Zingales (1997) as firms with negative cash flow exhibit lower investment-cash flow sensitivity than firms with positive cash flow. They conclude that firms with negative cash flow are usually financially distressed and are therefore unable to finance their investments using internal cash flow because creditors are likely to force these firms to use the internal cash to repay debt.

Cleary, Povell and Raith (2007) extend the investment-cash flow sensitivity literature by proposing a U-shaped relationship between internal funds and corporate investment. They suggest that investment decreases with a decline in internal funds for firms that have medium to high levels of internal funds. However, when internal funds fall below a threshold level, a further decline results in an increase in investment. These results support the findings of Allayannis and Mozumdar (2004), which show the investment-cash flow sensitivity is negative for a subsample of firms with negative internal cash flow.

Overall, the literature tends to suggest that financing constraints exist due to market imperfections that create a wedge between the cost of internal and external capital. However, there is less agreement as to what sign of the investment-cash flow sensitivity indicates the existence of financing constraints. Given this disagreement in the literature, our analysis takes into account several firm characteristics that may be linked to firms' ability to raise external capital. These characteristics include firm size, dividend cuts/omissions, filing for receivership/liquidation, leverage and new equity issues (Kaplan and Zingales, 1997; Goergen and Renneboog, 2001). In addition, we use the Kaplan-Zingales (KZ) index (Lamont, Polk and Saa-Requejo, 2001; Hong, Wang and Yu, 2008) in our multivariate regression analysis. Following Allayannis and Mozumdar (2004) and Cleary, Povell and Raith (2007), we allow for potential non-monotonicity by paying special attention to the sub-panels of firms with and without negative cash flow.

In the remainder of this section we develop testable hypotheses on the link between insider trading and financing constraints measured by the investment-cash flow sensitivity. We discuss channels through which insider trading may affect the wedge between the cost of internal and external capital, and, in turn, may determine firms' reliance on internal cash flow. We highlight the potential difference between insider sales and purchases in terms of their impact on the investment-cash flow sensitivity.

2.1. Insider trading and investment-cash flow sensitivity – The information effect

Building upon Kyle (1985) and Glosten and Milgrom (1985), a large number of studies examine how the private information of informed traders is incorporated in stock prices and how the ability of these traders to benefit from information-based trading affects the behaviour of other investors and market makers. A growing portion of this literature focuses on trading by one particular type of informed traders, namely, corporate insiders, who are expected to have more information about their firm's prospects than outside investors. Corporate insiders have an advantage not only in terms of the information they hold about the value of the firm's projects in place but also about how uncertainty associated with these prospects is resolved (Fishman and Haggerty, 1992; Bebchuk and Fershtman, 1994; Giammarino, Heinkel, and Hollifield, 1994). Consequently, trading by insiders, who are also in charge of corporate decision-making, is likely to convey private information about the firm's prospects to outside investors (Leland, 1992; and Bernhardt, Hollifield and Hughson, 1995).

There exists ample evidence consistent with this 'information effect' of insider trading. In detail, a large body of literature based on US and UK data suggests that insider purchases convey favourable private information to the market, resulting in a significantly positive market reaction, whereas insider sales convey unfavourable private information, causing the exact opposite market reaction (Seyhun, 1986; Gregory, Matatko, Tonks and Purkis, 1994; Lakonishok and Lee, 2001; Friederich, Gregory, Matatko and Tonks, 2002; Fidrmuc, Goergen and Renneboog, 2006).

A related strand of literature examines insider trading around important corporate events, such as dividend distributions and share buybacks (John and Lang, 1991; Jategaonkar, 2013). This literature suggests that insider trading acts as a credible signal about the value-relevance of corporate decisions made by insiders. John and Lang (1991) show that the market reaction to dividend announcements depends on signals emitted by insider trading prior to the announcements. More specifically, the reaction is positive for firms with prior intense insider purchasing and negative for firms with prior intense insider selling. Jategaonkar (2013) examines insider trading around open market repurchases. Building upon the argument that firms usually engage in share buybacks when their equity is undervalued, Jategaonkar (2013) shows that the market reaction to open market repurchases is more favourable when these transactions are preceded by high net insider purchases. This evidence is consistent with the argument that insider purchases provide a favourable signal about the value of the firm. Overall, the literature provides substantial support for the argument that insider purchases convey favourable information about the firm's prospects to outside investors, whereas insider sales convey unfavourable information. We relate this literature on the information effect of insider trading to the investment-cash flow sensitivity.

As mentioned earlier, the presence of information asymmetries makes it difficult for outside investors to distinguish between firms with good prospects and those with bad prospects. Consequently, a firm's investment is likely to be sensitive to internal cash flow because the cost at which outsiders are willing to provide capital is expected to be higher than that of internal capital (Fazzari, Hubbard and Petersen, 1988). Within this context, insider trading is relevant because it reveals insiders' private information to outside investors. Specifically, insider trading enables outside investors to distinguish between firms with good prospects and those with poor prospects by conveying additional information to investors enabling them to form expectations about the future cash flows of firms (Giammarino, Heinkel and Hollifield, 1994). Thus, outside investors are likely to revise their assessment of the firm's prospects, and the cost at which they are willing to provide capital, by taking into account the information conveyed by insider trading. In other words, insider trading, by providing additional information to investors, is expected to reduce the wedge between

the cost of internal capital and external capital and to reduce the firm's reliance on internal funds. We hypothesise that:

Hypothesis 1a: Insider trading (both purchases and sales) reduces the investment-cash flow sensitivity.

The above discussion does not distinguish between insider purchases and sales when assessing the effect of insider trading on the investment-cash flow sensitivity. However, the revisions in investors' assessments of the firm's prospects, and the cost at which investors are willing to provide capital to the firm, may depend on whether insider trading reveals favourable or unfavourable information. For example, suppose the firm raises external capital by issuing securities (debt or equity) in the presence of information asymmetry in the market. Outside investors may undervalue securities issued by firms with good prospects to recoup losses that they make on overvalued securities issued by firms with poorer prospects (Fazzari, Hubbard and Petersen, 1988). In essence, securities are priced such that outside investors are willing to provide capital at an average cost to all firms (Akerlof, 1970; Greenwald, Stiglitz and Weiss, 1984; Myers and Majluf, 1984).

Insiders of firms with good prospects, who have private information about the value of their firm, will have incentives to purchase the undervalued shares of their firm to benefit from future price increases when the uncertainty surrounding their firm's projects is resolved. In contrast, insiders of firms with poor prospects will have incentives to sell their overvalued shares to avoid future price decreases. Consequently, the share price is expected to increase with insider purchases as outside investors revise upwards the value of the firm. The opposite price movement is expected for the case of insider sales. As noted earlier, there is strong and consistent evidence suggesting that share prices increase in response to insider purchases, whereas share prices decrease in response to insider sales (Fidrmuc, Goergen and Renneboog, 2006). We argue that the revisions in investors' assessment of the firm's prospects after insider purchases, and a corresponding increase in the

firm's stock price, reduce the wedge between the costs of internal and external capital. From this perspective, the favourable signals emitted by insider purchases partially alleviate financing constraints by enabling firms to raise external capital at a lower cost. In other words, due to the favourable information conveyed by insider purchases, firms find it easier to raise external capital, and, in turn, rely less on internal capital. However, downward revisions in outside investors' assessment of the firm's prospects following insider sales make external capital more expensive. Thus, firms whose insiders sell may find it more difficult to raise external capital and therefore rely more heavily on internal cash flows. Hence, we propose the following two hypotheses regarding the differential information effect of insider purchases and sales:

Hypothesis 1b: Insider purchases decrease the investment-cash flow sensitivity.

Hypothesis 1c: Insider sales increase the investment-cash flow sensitivity.

To sum up, we argue that insider sales are driven by negative news, the revelation of which increases the cost of external financing. However, at the same time, the negative news about the project may also increase the cost of *internal* financing (i.e., the project's true cost of capital). In other words, as the bad news may cause an increase in both the internal cost of financing and the external cost of financing, the wedge between the two may stay constant. However, when insiders receive unfavourable new information about the value/prospect of the firm, they are likely to want to reap the benefit from selling the overpriced shares. They are likely to expect their sales will act as negative signals to the market, which, in turn, may exacerbate the financing constraints faced by their firms. Thus, when the managers sell, they assess the benefit they obtain from selling overpriced stock against the cost to their firms via the tightening of the financing constraints (Giammarino, Heinkel and Hollifield 1994). As our objective is to examine the impact of completed insider trades, we argue that the insiders sell after comparing the above cost and benefit. In what follows, we explicitly assume that the insiders have known the bad information for some time and

that the internal cost of capital has already adjusted to the news, whereas the external cost of capital still needs to adjust via conveying the new information through insider trades. We acknowledge that this could be a limitation to our paper.[2]

2.2. Insider trading and the investment-cash flow sensitivity – the confidence effect

Trading by corporate insiders may reduce outsiders' confidence in the market if outsiders perceive that insiders trade on the basis of unfair informational advantage (Ausubel, 1990; Fishman and Haggerty, 1992; Leland, 1992). For example, insiders are more likely to trade with outside investors, including market makers, when they believe their shares to be mispriced. To compensate for this risk of adverse selection, outside investors may require, on average, a higher return from their shares (Manove, 1989) and market makers may post a higher bid-ask spread (Leland, 1992). Consequently, insider trading is likely to impair market liquidity, which, in turn, results in lower share prices and a higher cost of capital (Manove, 1989; and Ausubel, 1990). Investors may perceive that the potential gains associated with insider trading provide insiders with incentives to manipulate and/or delay value-relevant information (Narayanan, 2000).[3]

In support of the above arguments, recent studies provide evidence of a significant impact of insider trading on managerial incentives and market liquidity. Cheng and Lo (2006) show that insiders release bad forecasts to reduce the stock price before they buy shares (see also Piotroski and Roulstone, 2005). Cao, Field and Hanka (2004) report that large-scale insider trading around lockup expirations in initial public offerings (IPOs) increases the bid-ask spread temporarily. Chung and Charoenwong (1998) report larger bid-ask spreads for stocks with more insider trading. Bettis, Coles and Lemmon (2000) find lower bid-ask spreads during blackout periods, i.e., periods when insiders are not allowed to trade. There is considerable evidence that insider trading impairs liquidity and that it influences insiders' incentives. We argue that in turn, this increases the wedge between the cost of internal and external capital, making firms rely more heavily on internal funds. In other word, the

[2] We are grateful to an anonymous referee for pointing out this issue.
[3] The gains associated with insider trading may also provide incentives to undertake very risky projects, which may or may not benefit investors (Bebchuk and Fershtman, 1994).

wedge between the cost of internal and external capital is increased because outside investors may undervalue firms whose insiders manipulate or delay information to reap benefits from information-based trading. We hypothesise that:

Hypothesis 2: Insider trading (both purchases and sales) increases the investment-cash flow sensitivity.

Both Hypotheses 1c and 2 predict an increase in financing constraints following insider sales. In contrast, Hypotheses 1b and 2 disagree as to the effects of insider purchases on financing constraints. Hypothesis 2 predicts that insider purchases worsen financing constraints by reducing investor confidence and Hypothesis 1b predicts that insider purchases alleviate financing constraints by signaling favorable information about the firm's prospects. However, these two contrasting effects of insider purchases need not be mutually exclusive. Insider purchases may impair liquidity and reduce investor confidence as well as conveying positive information about the firm. Then arises the question of which of the two effects dominates for insider purchases. We shall return to this issue when discussing our results.

2.3. Trades by executive and non-executive directors

The existing literature on insider trading also suggests that the market reaction to insider trading, and the strength of signals emitted by this trading, depends on the types of directors that are trading (Seyhun, 1986; Fidrmuc, Goergen, and Renneboog, 2006). Specifically, the trades of executive directors may convey more information than those of non-executive directors because the former are more closely associated with the firm's operations and strategies. This is the 'information hierarchy hypothesis' (Fidrmuc, Goergen, and Renneboog, 2006) as proposed by Seyhun. The support for this hypothesis is mixed. While Seyhun finds support for the hypothesis for the case of US firms (see also Jeng, Metrick and Zeckhauser, 2003), Fidrmuc, Goergen, and Renneboog (2006) do not find any support for the case of UK firms (see also Ataullah, Davidson, Le and Wood, 2012).

We seek to examine whether the trades of executive directors have a greater information/confidence effect on the investment-cash flow sensitivity than those of non-executive directors. This discussion leads to the following hypothesis:

Hypothesis 3: The impact of executive directors' trades on the investment-cash flow sensitivity is greater than that of non-executive directors' trades.

3. Data and methodology

3.1. Data

We obtain financial and accounting data from Datastream. We start with the list of all UK firms for which accounting and financial data are available in Datastream for at least four consecutive years during the period of 1995 to 2011. We exclude financial firms and utilities because these firms have different reporting systems as well as different investment and financing behaviour (Goergen and Renneboog, 2001). We delete firm-years with missing data on total assets, capital expenditures, or market capitalization. We also delete firm-years with negative book value of equity or zero total assets. Data on filing for receivership or liquidation are from London Share Price Database (LSPD). Data on open market purchases and sales by insiders for our sample firms are sourced from Hemmington Scott.[4] To ensure that our insider trading variables are measured at the same point in time as our accounting data, we base our measures for insider trading on each firm's financial year. Our final sample consists of an unbalanced panel of 15,858 firm-year observations covering 1,971 UK firms for the period of 1995 to 2011.

[4] Similar to Ke, Huddart and Petroni (2003) and Fidrmuc, Goergen and Renneboog (2006), we exclude insider trades due to the exercise of stock options because the information content of such transactions is usually low and the inclusion of the exercise of stock options may also lead to double counting.

3.2. Model specification and definitions of the variables

To test our hypotheses on the impact of insider trading on the investment-cash flow sensitivity, we estimate a dynamic model of investment (Goergen and Renneboog, 2001; Carpenter and Guariglia, 2008):

$$I_{it} = {}_1 I_{it\ 1} + {}_2 CF_{it} + {}_3 Q_{it\ 1} + {}_4 CF_{it} \times IT_{it\ 1} + \sum_p {}_p \times CF_{it} \times CONTROL_p + {}_t + {}_i + {}_{it}$$

where indices *i* and *t* denote the firm and year, respectively; *I* is investment, which is defined below, along with the other variables; *CF* denotes cash flow; *Q* is Tobin's Q; *IT* denotes various measures of insider trading; *CONTROL* represents one of the *p* different control variables that we use in line with the existing literature; α_t and γ_i are firm-specific and time-specific fixed-effects, respectively; and ε_{it} is the error term. Our primary interest is in the coefficient β_4, which measures the link between insider trading and the investment-cash flow sensitivity. Given the possibility of a non-monotonic relationship between investment and cash flow, following Allayannis and Mozumdar (2004) and Cleary, Povell and Raith (2007), we estimate the above model for the full panel as well as for the sub-panel of firm-years with positive cash flow only.

We use the Generalised Method of Moments in system (GMM_{sys}), as developed by Arellano and Bond (1991) and Blundell and Bond (1998), consisting of equations in levels as well as equations in first differences. GMM_{sys} uses the lagged differences of the dependent variable and the independent variables as instruments in the levels equations and uses the levels of the dependent variable and the independent variables as instruments in the first-differenced equations. Compared to other estimation techniques used in the literature, the GMM_{sys} estimator is more efficient because it controls for biases due to unobserved firm-specific heterogeneity and possible endogeneity of the independent variables (Wintoki, Linck and Netter, 2012). The OLS estimate of the coefficient on the lagged dependent variable will be upward biased while the fixed-effects (within-groups) estimator will eliminate the firm-specific fixed-effects but provide an inconsistent and downward biased estimate of the coefficient on the lagged dependent variable (Nickell, 1981). The GMM_{sys} estimator mitigates the shortcomings that the GMM_{diff} estimator (first-differences GMM) suffers

from for the case of relatively short panels, given that the lagged levels of the variables are weak instruments for the first-differenced equations (Blundell and Bond, 1998).[5] We use the levels of the dependent and independent variables dated *t-4* as instruments for the first-differenced equations and the first differences dated *t-3* as instruments for the levels equations. Put differently, GMM_{sys} adjusts for both omitted variable bias (which the within-groups estimator and GMM_{diff} also do) and dynamic endogeneity (which they do not do) (Wintoki, Linck and Netter, 2012).

The validity of the GMM_{sys} estimator depends on the validity of the instruments used. We perform the Hansen test of over-identification, which yields a *J*-statistic, which follows a χ^2 distribution under the null hypothesis of the validity of our instruments and the Difference-in-Hansen test, which also yields a *J*-statistic, which follows a χ^2 distribution under the null hypothesis that the subset of instruments that we use in the levels equations are exogenous (Roodman, 2009). We test for the validity of the levels of the dependent and independent variables dated *t-4* and the first differences dated *t-3* as instruments using the tests for first-order and second-order serial correlation of the residuals (m_1 and m_2) (Arellano and Bond, 1991). We account for the time-specific effect by including time dummies in our specifications.

Table 1 lists and defines all the variables used in this paper. Similar to Chen, Goldstein and Jiang (2007), investment, *I*, is measured by capital expenditure. Cash flow, *CF*, is the sum of net income before extraordinary items, depreciation and amortisation expenses and research and development (R&D) expenses. Following Chen, Goldstein and Jiang (2007), both *I* and *CF* for year *t* are scaled by the book value of total assets for year *t-1*. Tobin's Q, *Q*, is included in the standard investment-cash flow regression to control for growth opportunities. In line with previous studies, *Q* is the ratio of the market value of equity minus the book value of equity plus the book value of assets to the book value of assets (Hadlock, 1998; Chen, Goldstein and Jiang, 2007; and Cleary, Povell and Raith, 2007).

We include the interaction between cash flow and a number of firm-specific characteristics used in previous studies on the investment-cash flow sensitivity. These are: *D_Q*, a dummy variable

[5] More specifically, when the panel is short the GMM_{diff} estimator will also be downward biased.

that equals one if Tobin's Q is higher than the sample median; *D_R&D*, a dummy variable that is set to one if there is R&D expenditure; and firm size, *SIZE*, the natural logarithm of market capitalisation. Both Hadlock (1998) and Pawlina and Renneboog (2005) find that firms with more growth opportunities have higher investment-cash flow sensitivity. Hadlock also finds that, for the USA, the investment-cash flow sensitivity is higher for R&D-intensive firms, perhaps due to higher information asymmetries associated with R&D expenditures (see also Huddart and Ke, 2007). In contrast, Bond, Harhoff and Van Reenen (1999) report that UK firms that engage in R&D activities have lower investment-cash flow sensitivity. While Hadlock shows that larger US firms do not have higher investment-cash flow sensitivity, Devereux and Schiantarelli (1990) show size is important for UK firms (see also Bond, Harhoff and Van Reenen, 1999).

To check the robustness of our results and to confirm that the investment-cash flow sensitivity is an adequate measure of financing constraints, we also include the interaction between cash flow and various dummy variables set to one if: i) the firm reduces dividend payments or omits dividends, (*D_Dividend_Cut*); ii) the firm issues new equity, (*D_ Equity_Issue*); iii) the firm has interest coverage of less than 2, (*D_Coverage_less_than_2*); iv) the firm files for receivership or liquidation, (*D_Receivership_Liquidation*); and v) more than one of the above conditions are met (*D_Financing_Needs*). We include the interaction between cash flow and a measure of financing constraints per Kaplan and Zingales (1997). This measure is the KZ index. It is based on five variables that are calculated for each firm-year and it is constructed as follows (Lamont, Polk and Saa-Requejo, 2001):

$$KZ_{it} = -1.002\ CF_{it} - 39.368\ DIV_{it} - 1.315\ Cash_{it} + 3.139\ LEV_{it} + 0.283\ Q_{it}$$

where CF_{it} is cash flow; DIV_{it} is cash dividends and $Cash_{it}$ is cash balances; all the former are scaled by the book value of total assets for the previous year. LEV_{it} is total debt over the sum of total debt and book value of equity; and Q_{it} is the above defined Tobin's Q. Hong, Wang and Yu (2008) follow the same approach to calculate the KZ index for both US and non-US firms.

INSERT TABLE 1 ABOUT HERE

To test the confidence and information effects of insider trading on the investment-cash flow sensitivity, we use the following measures of insider trading: (i) *TOTAL_VALUE,* which is the natural logarithm of the total pound sterling value of shares traded (purchased and sold) by insiders in a year; (ii) *NETPURCHASES_VALUE,* which is the pound sterling value of net purchases (i.e., the value of shares purchased minus the value of shares sold by insiders) as a proportion of the total value of shares traded by insiders in a year; (iii) *PURCHASES_VALUE*, which is the natural logarithm of the total value of shares purchased; (iv) *SALES_VALUE,* which is the natural logarithm of the total value of shares purchased; (v) *POSITIVE_NP_VALUE,* which is max(0,*NETPURCHASES_VALUE*); and, (vi) *NEGATIVE_NP_VALUE,* which is min(*NETPURCHASES_VALUE*,0). All variables take on the value of zero for firm-years without any insider trading.[6] Thus, *NETPURCHASES_VALUE* lies in the interval [-1,1], whereas *POSITIVE_NP_VALUE* and *NEGATIVE_NS_VALUE* lie in [0,1] and [-1,0], respectively.[7] *NETPURCHASES_VALUE* will be positive if there are net purchases, but negative if there are net sales. We check the robustness of our results by using the equivalent measures for insider trading based on the number of shares traded.

Our econometric model is built upon the assumption that the insider trading in the recent past (year *t-1*) contains information that outside investors utilize today (year *t*) to determine the amount (and the cost) of capital that they are willing to provide. Our hypotheses suggest that the observable insider trading in the recent past (i.e., year *t-1*) may either alleviate or exacerbate financing constraints (as per the information and the confidence effects of insider trading). When non-myopic corporate insiders sell or purchase shares of their firm in year *t-1*, they expect that they are trading on the basis of their superior information. However, they anticipate that their trading in

[6] *NETPURCHASES_VALUE, POSITIVE_NP_VALUE* and *NEGATIVE_NP_VALUE* also take on the value of zero for firm-years where the value of insider purchases is the same as the value of insider sales.

[7] We thank an anonymous referee for suggesting the use of this alternative set of measures for *NETPURCHASES_VALUE*.

year *t-1* will convey information about the prospects/value of their firm, which, in turn, is likely to affect outside investors' decision to provide capital in year *t*.

One may argue that the trades in the years prior to *t-1* are likely to have less private information that is not already available in the market and are therefore less likely to affect the financing constraints in year *t*. However, trading in the years prior to *t-1* may have long-term reputational effects. Thus, in regressions not reported in the paper,[8] we use insider trading for year *t-2* on the right-hand side. Our results suggest that there is no such reputational effect given that the coefficients on insider trading measured in year *t-2* are not statistically insignificant.

3.3. Descriptive statistics

Panel A of Table 2 presents summary statistics for the data. Following the standard practice in the literature we winsorise all accounting variables at the 1st and 99th percentiles to mitigate the potential effects of outliers. The average (median) investment – scaled by total assets from the previous year – is 0.062 (0.036). The average (median) cash flow – scaled by total assets from the previous year – is 0.036 (0.082). The average (median) *Q* is 1.938 (1.400).

INSERT TABLE 2 ABOUT HERE

Panel B of Table 2 reports the means for the key variables for the full panel as well as for the sub-panel of firm-years with positive cash flow and the sub-panel of firm-years with negative cash flow. Compared to firm-years with negative cash flow, firm-years with positive cash flow have on average higher investment, but a lower Tobin's Q. Firm-years with positive cash flow are almost ten times larger than firm-years with negative cash flow as measured by the market capitalisation and spend about six times more on R&D. Insiders in firm-years with positive cash flow trade more than insiders in firm-years with negative cash flow. Indeed, the average value of purchases and sales by insiders in firm-years with positive cash flow is much higher than that in firm-years with negative cash flow. However, for both sub-panels of firm-years with positive and negative cash

[8] These regression results are available upon request from the authors.

flow, the average value of insider sales is much larger than the average value of insider purchases.[9] These differences in the means are statistically significant at the 1% level. In contrast, there is no difference between the medians (not tabulated) and these are all equal to zero.

4. Results

4.1. Insider trading and investment-cash flow sensitivity

Table 3 reports the estimation results for the investment-cash flow regressions for the full panel in Columns (1), (3) and (5) and for the sub-panel of firm-years with positive cash flow in Columns (2), (4) and (6). We include the two interactions of cash flow with each of the two key variables for insider trading, i.e. *TOTAL_VALUE* and *NETPURCHASES_VALUE*, separately (Columns (1) to (4)) as well as together (Columns (5) and (6)) in the regressions. As discussed above, the GMM_{sys} estimator avoids biases due to unobserved heterogeneity and possible endogeneity of the regressors, whereas the fixed-effects estimator only deals with the former. The results from the Hansen *J*, m_1 and m_2 tests do not reject the validity of the levels of the dependent and independent variables dated *t-4* and the first differences dated *t-3* as instruments in the GMM_{sys} regressions.[10] Furthermore, the Difference-in-Hansen test suggests that the subset of instruments for the levels equation is valid.

Table 3 shows that the coefficient on the lagged dependent variable is positive and highly significant in all six regressions. However, the coefficient on cash flow is not statistically significant in any of the regressions. Some studies find similar results of an absence of the investment-cash flow sensitivity. For example, Hadlock (1998) does not find an investment-cash flow sensitivity for his sample of 435 firms, but finds such a sensitivity for sub-samples based on different levels (i.e., quartiles) of insider ownership. Goergen and Renneboog (2001) find no significant investment-cash

[9] This is in line with Fidrmuc, Goergen and Renneboog (2006) for the large trades, i.e., those greater than 0.1% of firm's market capitalization, by UK corporate insiders during 1991-1998.

[10] For the full panel we do not use the interactions as instruments because their inclusion results in the Hansen test of over-identification rejecting the null hypothesis of the overall validity of our instruments.

flow sensitivity for their sample of UK firms, except for sub-samples based on financing constraints and on control and ownership.

INSERT TABLE 3 ABOUT HERE

The results from Columns (1), (3) and (5) suggest that insider trading, independent of whether it is measured as the total value of all insider trades or as the value of net insider purchases, does not have any significant impact on the investment-cash flow sensitivity for the full panel that includes both firm-years with positive cash flow and firm-years with negative cash flow. For the sub-panel of firm-years with positive cash flow, the coefficient on *CF×TOTAL_VALUE* is positive and statistically significant in Column (2) but is insignificant when the interaction term with net insider purchases is included in Column (6). There is weak support for our Hypothesis 2 that the confidence effect leads to tighter financing constraints when outside investors perceive that insiders benefit from their informational advantage via insider trading.[11]

As a reminder, *NETPURCHASES_VALUE* will be positive if there are net purchases, but negative if there are net sales. The coefficient on *CF×NETPURCHASES_VALUE* is negative and statistically significant in both Columns (4) and (6). This suggests that, for firm-years with positive cash flow, the more positive is *NETPURCHASES_VALUE*, i.e., the greater the net purchases value of insider trades, the weaker the investment-cash flow sensitivity. On the other hand, the more negative the *NETPURCHASES_VALUE*, i.e., the greater the net sales value of insider trades, the stronger is the investment-cash flow sensitivity. This result indicates that the impact of insider purchases and that of insider sales on firms' financing constraints are different. This is consistent with our Hypotheses 1b and 1c that, when insiders purchase (sell) shares, they reveal favorable (unfavorable) information about the firm's prospects and thus the more they purchase (sell) the less (more) the firm's investment is constrained by its cash flow. This could be the reason why the

[11] We test the joint significance of the coefficients on cash flow and its interaction with measures of insider trading using a Wald test and a test based on the GMM-criterion. For almost all cases for the sub-panel of firm-years with positive cash flow the null hypothesis that the coefficients are not jointly significantly different from 0 is rejected.

coefficient on *CF×TOTAL_VALUE* becomes insignificant when *CF×NETPURCHASES_VALUE* is included in Column (6). The difference in results regarding the impact of insider trading on the investment-cash flow sensitivity caused by the inclusion or not of firm-years with negative cash flow confirms the non-monotonic nature of the relation between investment and internal funds as reported in Allayannis and Mozumdar (2004) and Cleary, Povell and Raith (2007)[12].

4.2. Insider purchases, insider sales and investment-cash flow sensitivity

Table 4 reports the analysis that allows for the potentially differential effect of insider purchases and insider sales on the investment-cash flow sensitivity. As in Table 3, we report the estimation results for the full panel as well as for the sub-panel of firm-years with positive cash flow. We estimate the regression with the interaction terms of cash flow with *PURCHASES_VALUE* and *SALES_VALUE*, respectively. Similar to Table 3, we do not find any significant impact of insider trading for the full panel regressions (Columns (1) and (3) of Table 4). For the sub-panel of firm-years with positive cash flow, we find a statistically significant and negative coefficient on *PURCHASES_VALUE* and a statistically significant and positive coefficient on *SALES_VALUE*. This supports Hypothesis 1b that states that insider purchases decrease the investment-cash flow sensitivity as well as Hypothesis 1c that states that insider sales increase the investment-cash flow sensitivity.

INSERT TABLE 4 ABOUT HERE

In Columns (3) and (4) of Table 4 we include the interactions of *CF* with *POSITIVE_NP_VALUE* and *NEGATIVE_NP_VALUE*, respectively. The latter two variables range from 0 to 1 and -1 to 0, respectively. They allow for a potentially different impact of net purchases and net sales on the investment-cash flow sensitivity. For the sub-panel of firm-years with positive cash flow, both the coefficients on *POSITIVE_NP_VALUE* and *NEGATIVE_NP_VALUE* are

[12] In results not reported in the paper, we included all the interaction variables on a stand-alone basis. Our key results remain qualitatively similar.

negative although only the latter is statistically significant. This is largely in line with the results reported in Table 3 for the interaction term with *NETPURCHASES_VALUE*. The results in Table 4 are consistent with Hypotheses 1b and 1c.

4.3. Insider trading, investment-cash flow sensitivity and information hierarchy

In this section we investigate if the above reported effect of insider trading on financing constraints varies with the type of directors who trades. Given the results in Tables 3 and 4 we focus on the sub-panel of firm-years with positive cash flow and do not estimate the investment model for the entire panel. Further, the measures of insider trading now distinguish between trades by executive directors and those by non-executive directors. As there are no purchases by non-executive directors in our sample data, we only use *SALES_VALUE* for the regression for trades by these directors.

INSERT TABLE 5 ABOUT HERE

Table 5 reports the estimation results for trades by executive directors in Columns (1), (2) and (3) and for those by non-executive directors in Column (4). The coefficients on the interactions of cash flow with each of the six measures of insider trading for the trades by executive directors are qualitatively similar to those reported in Tables 3 and 4, supporting Hypotheses 1b, 1c and 2. The coefficient on the interaction of cash flow with *SALES_VALUE* for the trades by non-executive directors is however statistically insignificant. This is in line with our Hypothesis 3 that the impact of trades by executive directors on the investment-cash flow sensitivity is larger than that of trades by non-executive directors. It may indicate that insider sales by non-executive directors are motivated by liquidity needs (Fidrmuc, Goergen and Renneboog, 2006) and, thus, do not have any information/confidence effects on financing constraints.

5. Robustness checks

In this section we provide robustness checks to ensure that our previously reported results are not sensitive to the way we measure insider trading and/or to the omission of variables that might be associated with firms' financing constraints. First, we re-estimate the regressions from Tables 3 and 4 using alternative measures of insider trading which are based on the number of shares traded rather than the pound sterling value of the shares traded. The results of the estimation for these new measures of insider trading for the sub-panel of firm-years with positive cash flow are reported in Table 6. Overall our results reported in Tables 3 and 4 remain unchanged when these measures of insider trading are used.[13]

INSERT TABLE 6 ABOUT HERE

Second, given the controversy in the literature about the validity of the investment-cash flow sensitivity as a measure of financing constraints, we check our results when we control for firm-specific characteristics that are normally associated with financing constraints. Table 7 focuses on the sub-panel of firm-years with positive cash flow. The table reports the estimation results for the regressions including the interaction between cash flow and various dummy variables for financing needs. These include dividend cuts/omissions, filing for receivership or liquidation, interest coverage, new equity issues and the KZ index (Kaplan and Zingales, 1997; Goergen and Renneboog, 2001). We focus on the first two insider trading measures, i.e., *TOTAL_VALUE* and *NETPURCHASES_VALUE*. With the exception of the interaction with the KZ index, none of the coefficients on the interactions between cash flow and the other measures of financing needs are statistically significant. After controlling for these measures of financing constraints, our results regarding the effect of insider trading on the investment-cash flow sensitivity are upheld. The estimation results for the other insider trading measures are also similar to those reported in Tables 3 and 4 and are not reported here for the sake of brevity.

INSERT TABLE 7 ABOUT HERE

[13] We do not find any significant impact of these alternative measures of insider trading on the investment-cash flow sensitivity for the full panel. The results for these regressions are not reported for sake of brevity and are available from the authors upon request.

6. Conclusion

Insider trading may reduce information asymmetries by conveying insiders' value-relevant information to outside investors. This information effect is likely to alleviate corporate financing constraints. However, insider trading may also reduce investors' confidence by impairing market liquidity and by inducing insiders to manipulate or delay the release of information to outsiders. This confidence effect is likely to exacerbate financing constraints. This paper aims to shed light on whether any of these two effects exists and, if both exist, which one dominates.

We test the validity of our hypotheses using an unbalanced panel of 15,858 firm-year observations covering 1,971 UK firms for the period of 1995 to 2011. We find evidence to suggest that the overall insider trading increases the investment-cash flow sensitivity. That is, there is weak support for the confidence effect of insider trading that insider trading, whether purchases or sales, reduces investor confidence in the firm and hence reduces the firm's access to outside finance. However, when we distinguish between insider purchases and insider sales, we find that the former reduce the investment-cash flow sensitivity, whereas the latter increase it. This is consistent with our hypotheses that suggest that insider purchases reduce the investment-cash flow sensitivity by revealing favourable information, while insider sales increase the investment-cash flow by conveying unfavourable information about the firm's prospects. This suggests that the information effect dominates the confidence effect for insider purchases. We find that only trades by executive directors, who are normally more closely associated with their firm's operations and long-term strategies, affect the investment-cash flow sensitivity. Our findings shed light on the debate about the economic costs and benefits of insider trading by showing that these trades are important signals for outside investors when deciding on whether to make their funds available to a given firm.

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Table 1

Variable Definition

Firm Characteristics	All firm-characteristic variables are calculated using data from Datastream with the exception of *D_Receivership_Liquidation*, which uses data from LSPD.
I	Capital expenditure scaled by total book value of assets for the previous year.
CF	(Net income before extraordinary items + depreciation and amortization expenses + R&D expenditure) / total book value of assets for the previous year
Q	(Market value of equity + book value of assets – book value of equity) / total book value of assets for the previous year
SIZE	Natural logarithm of market capitalisation at the beginning of year
TA	Total book value of assets (£ millions)
D_Q	Dummy variable that equals one if Tobin's Q is above the sample median
D_R&D	Dummy variable that equals one if R&D expenditure is not zero
D_Dividend_Cut_Omission	Dummy variable that equals one if a firm reduces dividend payments or omits dividends
D_ Equity_Issue	Dummy variable that equals one if a firm issues new equity
D_Coverrage_less_than_2	Dummy variable that equals one if a firm has the interest coverage less than 2
D_Receivership_Liquidation	Dummy variable that equals one if a firm files for receivership or liquidation
D_Financing_Needs	Dummy variable that equals one if a firm does one of the followings: i) reduces dividend payments or omits dividends; ii) issues new equity; iii) has the interest coverage less than 2; or iv) files for bankruptcy
KZ	Five-variable KZ index per Kaplan and Zingales (1997). The five variables are cash flow (CF_{it}), cash dividends (DIV_{it}), cash balances ($Cash_{it}$) (all scaled by the book value of total assets for the previous year), leverage (LEV_{it}) defined as total debt over the sum of total debt and book value of equity; and Tobin's Q (Q_{it}). The index is equal to $KZ_{it} = -1.002\ CF_{it} - 39.368\ DIV_{it} - 1.315\ Cash_{it} + 3.139\ LEV_{it} + 0.283\ Q_{it}$.
Insider Trading	All insider trading variables are calculated using data from Hemmington Scott.
TOTAL_VALUE	Natural logarithm of the total pound sterling value of shares traded (purchased and sold) by insiders in the given year. This variable takes a value of 0 if there is no insider trade.
NETPURCHASES_VALUE	The pound sterling value of shares purchased minus the pound sterling value of shares sold by insiders divided by the total pound sterling value of shares traded in the given year. This variable takes a value of 0 if there is no insider trade. This variable lies in the interval [-1,1]. *NETPURCHASES_VALUE* will be positive if there are net purchases, but negative if there are net sales.
PURCHASES_VALUE	Natural logarithm of the total pound sterling value of shares purchased by insiders in the given year. This variable takes a value of 0 if there is no insider trade.
SALES_VALUE	Natural logarithm of the total pound sterling value of shares sold by insiders in the given year. This variable takes a value of 0 if there is no insider trade.

POSITIVE_NP_VALUE	This variable takes max(0, *NETPURCHASES_VALUE*). This variable lies in the interval [0,1].
NEGATIVE_NP_VALUE	This variable takes min(*NETPURCHASES_VALUE*,0). This variable lies in the interval [-1,0].
TOTAL_SHARES	Natural logarithm of the total number of shares traded (purchased and sold) by insiders in the given year. This variable takes a value of 0 if there is no insider trade.
NETPURCHASES_SHARES	The number of shares purchased minus the number of shares sold divided by the total number of shares traded by insiders in the given year. This variable takes a value of 0 if there is no insider trade. This variable lies in the interval [-1,1]. *NETPURCHASES_SHARES* will be positive if there are net purchases, but negative if there are net sales.
PURCHASES_SHARES	Natural logarithm of the total number of shares purchased by insiders in the given year. This variable takes a value of 0 if there is no insider trade.
SALES_SHARES	Natural logarithm of the total number of shares sold by insiders in the given year. This variable takes a value of 0 if there is no insider trade.
POSITIVE_NP_SHARES	This variable takes max(0, *NETPURCHASES_SHARES*). This variable lies in the interval [0,1].

Table 2

Summary statistics

Panel A presents descriptive statistics for the variables in our analysis. Total number of observations is 15,858. Panel B presents the mean of key firm characteristics for the subpanel of firm-years with positive cash flow and of firm-years with negative cash flow. It also shows results of the difference in the means test across the two subpanels. All variables are defined in Table 1.

Panel A	*Mean*	*St dev*	*Median*	*Min*	*Max*
I	0.062	0.080	0.036	0	0.474
CF	0.036	0.213	0.082	-0.984	0.449
Q	1.938	1.747	1.400	0.499	11.873
SIZE	10.990	2.122	10.736	7.036	17.100
D_Q	0.500	0.500	0.5	0	1
D_R&D	0.321	0.467	0	0	1
D_Dividend_Cut_Omission	0.147	0.354	0	0	1
D_ Equity_Issue	0.618	0.486	1	0	1
D_Coverrage_less_than_2	0.294	0.456	0	0	1
D_Receivership_Liquidation	0.065	0.247	0	0	1
KZ	0.188	1.362	0.284	-6.676	7.007
D_Financing_Needs	0.274	0.446	0	0	1
TOTAL_VALUE	3.329	5.385	0	0	19.811
PURCHASES_VALUE	2.149	4.238	0	0	16.817
SALES_VALUE	2.647	4.980	0	0	19.811
NETPURCHASES_VALUE	-0.049	0.438	0	-1	1
POSITIVE_NP_VALUE	0.084	0.260	0	0	1
NEGATIVE_NP_VALUE	-0.133	0.319	0	-1	0
TOTAL_SHARES	3.266	5.286	0	0	18.617
PURCHASES_SHARES	2.156	4.291	0	0	16.737
SALES_SHARES	2.555	4.806	0	0	18.609
NETPURCHASES_SHARES	-0.047	0.437	0	-1	1
POSITIVE_NP_SHARES	0.085	0.260	0	0	1
NEGATIVE_NP_SHARES	-0.131	0.318	0	-1	0

Panel B	*Positive CF*	*Negative CF*
I	0.067***	0.048
CF	0.126***	-0.236
Q	1.759***	2.482
Market Cap. (£'000s)	1,707,727***	165,839
R&D Expenses (£'000s)	35,325***	5,784
Insider Trades (£)	356,556***	105,801
Insider Purchases (£)	36,227***	13,345
Insider Sales (£)	320,273***	92,455

*, ** and *** denote significance of the difference in means at the 10%, 5% and 1% level, respectively.

Table 3

Investment-cash flow sensitivity and value of insider trading

This table presents the results for the GMM-system regressions for the investment-cash flow equation for both the full panel (Columns (1), (3) and (5)) and the sub-panel of firm-years with positive cash flow (Columns (2), (4) and (6)). We use various value-based measures of insider trading interacted with cash flow. All variables are defined in Table 1. Figures in brackets are *p*-values based on the Windmeijer bias-corrected (WC) robust two-step GMM estimator. Year dummies are included in all specifications. m_1 and m_2 are the tests for the absence of first-order and second-order correlation in the residuals, respectively. The *p*-values are reported for the Hansen *J* test of over-identification under the null that all instruments are valid and the Difference-in-Hansen test of exogeneity under the null that instruments used for the equations in levels are exogenous.

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Pos. CF	All	Pos. CF	All	Pos. CF
I_{t-1}	0.510	0.640	0.510	0.641	0.510	0.642
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
CF	-0.164	-0.062	-0.141	0.049	-0.160	0.099
	(0.377)	(0.568)	(0.436)	(0.656)	(0.388)	(0.383)
Q	0.001	-0.005	0.000	-0.005	0.001	-0.005
	(0.885)	(0.138)	(0.937)	(0.068)*	(0.887)	(0.070
CF×D_Q	-0.049	-0.023	-0.049	0.004	-0.049	-0.023
	(0.649)	(0.711)	(0.645)	(0.942)	(0.646)	(0.686)
CF×D_R&D	-0.179	-0.072	-0.184	-0.095	-0.182	-0.082
	(0.053)*	(0.115)	(0.045)**	(0.022)**	(0.068)*	(0.054)*
CF×SIZE	0.028	0.016	0.026	0.011	0.028	0.006
	(0.176)	(0.102)	(0.187)	(0.264)	(0.180)	(0.531)
CF×TOTAL_VALUE	0.000	0.007			-0.001	0.005
	(0.944)	(0.073)*			(0.949)	(0.113)
CF×NETPURCHASES_VALUE			-0.007	-0.072	-0.003	-0.094
			(0.912)	(0.059)*	(0.972)	(0.009)***
Constant	0.015	0.011	0.015	0.007	0.014	0.008
	(0.088)*	(0.172)	(0.082)*	(0.327)	(0.104)	(0.264)
N	13,724	9,423	13,724	9,423	13,724	9,423
m_1	0.000	0.000	0.000	0.000	0.000	0.000
m_2	0.792	0.663	0.792	0.595	0.786	0.627
Hansen J	0.281	0.131	0.312	0.310	0.258	0.252
Difference-in-Hansen	0.450	0.460	0.504	0.690	0.444	0.794

*, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table 4

Investment-cash flow sensitivity and value of insider trading – alternative measures of insider trading

This table presents the results for the GMM-system regressions for the investment-cash flow equation for both the full panel (Columns (1) and (3)) and the sub-panel of firm-years with positive cash flow (Columns (2) and (4)). We use various value-based measures of insider trading interacted with cash flow. All variables are defined in Table 1. Figures in brackets are *p*-values based on the Windmeijer bias-corrected (WC) robust two-step GMM estimator. Year dummies are included in all specifications. m_1 and m_2 are the tests for the absence of first-order and second-order correlation in the residuals, respectively. The *p*-values are reported for the Hansen *J* test of over-identification under the null that all instruments are valid and the Difference-in-Hansen test of exogeneity under the null that instruments used for the equations in levels are exogenous.

	(1)	(2)	(3)	(4)
	All	Pos. CF	All	Pos. CF
I_{t-1}	0.502	0.611	0.511	0.627
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
CF	-0.150	0.029	-0.157	0.071
	(0.423)	(0.782)	(0.422)	(0.535)
Q	0.000	-0.003	0.000	-0.007
	(0.959)	(0.317)	(0.919)	(0.013)**
CF×D_Q	-0.056	-0.046	-0.061	-0.001
	(0.592)	(0.455)	(0.609)	(0.983)
CF×D_R&D	-0.184	-0.071	-0.169	-0.082
	(0.047)**	(0.091)*	(0.083)*	(0.050)**
CF×SIZE	0.027	0.016	0.027	0.009
	(0.197)	(0.077)**	(0.184)	(0.383)
CF×PURCHASES_VALUE	0.000	-0.009		
	(0.977)	(0.031)**		
CF×SALES_VALUE	-0.002	0.010		
	(0.829)	(0.004)***		
CF×POSITIVE_NP_VALUE			0.051	-0.026
			(0.764)	(0.677)
CF×NEGATIVE_NP_VALUE			-0.005	-0.166
			(0.960)	(0.000)***
Constant	0.015	0.002	0.015	0.009
	(0.076)*	(0.757)	(0.123)	(0.224)
N	13,724	9,423	13,724	9,423
m_1	0.000	0.000	0.000	0.000
m_2	0.822	0.637	0.749	0.623
Hansen J	0.289	0.296	0.235	0.397
Difference-in-Hansen	0.417	0.803	0.448	0.746

*, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table 5

Investment-cash flow sensitivity and value of insider trading by executive and non-executive directors

This table presents the results for the GMM-system regressions for the investment-cash flow equation for the sub-panel of firm-years with positive cash flow. We use various value-based measures of insider trading interacted with cash flow. Columns (1), (2) and (3) report the estimation results using the measures of insider trading by executive directors and Column (4) report the estimation results using the measures of insider trading by non-executive directors. All variables are defined in Table 1. Figures in brackets are *p*-values based on the Windmeijer bias-corrected (WC) robust two-step GMM estimator. Year dummies are included in all specifications. m_1 and m_2 are the tests for the absence of first-order and second-order correlation in the residuals, respectively. The *p*-values are reported for the Hansen *J* test of over-identification under the null that all instruments are valid and the Difference-in-Hansen test of exogeneity under the null that instruments used for the equations in levels are exogenous.

	Executive		Non-Executive	
	(1)	(2)	(3)	(4)
I_{t-1}	0.602	0.600	0.586	0.689
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
CF	-0.025	-0.051	-0.010	-0.042
	(0.827)	(0.624)	(0.935)	(0.680)
Q	-0.004	-0.003	-0.005	-0.004
	(0.264)	(0.374)	(0.144)	(0.151)
CF×D_Q	-0.019	-0.023	-0.032	-0.027
	(0.781)	(0.732)	(0.641)	(0.661)
CF×D_R&D	-0.072	-0.069	-0.078	-0.066
	(0.107)	(0.103)	(0.079)*	(0.127)
CF×SIZE	0.016	0.020	0.016	0.014
	(0.109)	(0.031)**	(0.094)***	(0.153)
CF×TOTAL_ VALUE	0.006			
	(0.088)*			
CF×NETPURCHASES_VALUE	-0.069			
	(0.054)**			
CF×PURCHASES_VALUE		-0.004		
		(0.319)		
CF×SALES_ VALUE		0.008		0.006
		(0.017)**		(0.271)
CF×POSITIVE_NP_VALUE			0.019	
			(0.747)	
CF×NEGATIVE_NP_VALUE			-0.204	
			(0.001)***	
Constant	0.007	0.005	0.007	0.013
	(0.342)	(0.512)	(0.415)	(0.104)
N	9,423	9,423	9,423	9,423
m_1	0.000	0.000	0.000	0.000
m_2	0.670	0.677	0.632	0.627
Hansen J	0.131	0.190	0.163	0.107
Difference-in-Hansen	0.698	0.774	0.669	0.509

*, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table 6

Investment-cash flow sensitivity and number of shares of insider trading

This table presents the results for the GMM-system regressions for the investment-cash flow equation for the sub-panel of firm-years with positive cash flow. We use various share-based measures of insider trading interacted with cash flow. All variables are defined in Table 1. Figures in brackets are *p*-values based on the Windmeijer bias-corrected (WC) robust two-step GMM estimator. Year dummies are included in all specifications. m_1 and m_2 are the tests for the absence of first-order and second-order correlation in the residuals, respectively. The *p*-values are reported for the Hansen *J* test of over-identification under the null that all instruments are valid and the Difference-in-Hansen test of exogeneity under the null that instruments used for the equations in levels are exogenous.

	(1)	(2)	(3)	(4)	(5)
I_{t-1}	0.640	0.641	0.639	0.607	0.623
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
CF	-0.070	0.046	0.099	0.034	0.056
	(0.516)	(0.669)	(0.373)	(0.751)	(0.622)
Q	-0.004	-0.005	-0.005	-0.003	-0.008
	(0.169)	(0.066)*	(0.066)*	(0.312)	(0.008)***
CF×D_Q	-0.030	0.008	-0.015	-0.052	0.005
	(0.641)	(0.890)	(0.787)	(0.399)	(0.938
CF×D_R&D	-0.071	-0.093	-0.083	-0.073	-0.085**
	(0.119)	(0.026)**	(0.056)*	(0.090)*	(0.045
CF×SIZE	0.018	0.011	0.006	0.016*	0.010
	(0.067)*	(0.271)	(0.496)	(0.069	(0.323)
CF×TOTAL_ SHARES	0.007		0.004		
	(0.119)		(0.194)		
CF×NETPURCHASES_ SHARES		-0.076	-0.097		
		(0.047)**	(0.006)***		
CF×PURCHASES_ SHARES				-0.011	
				(0.026)**	
CF×SALES_ SHARES				0.011	
				(0.006)***	
CF×POSITIVE_NP_ SHARES					-0.024
					(0.692)
CF×NEGATIVE_NP_ SHARES					-0.169
					(0.001)***
Constant	0.010	0.008	0.009	0.002	0.015
	(0.211)	(0.281)	(0.233)	(0.752)	(0.002)***
N	9,423	9,423	9,423	9,423	9,423
m_1	0.000	0.000	0.000	0.000	0.000
m_2	0.662	0.608	0.636	0.646	0.543
Hansen J	0.121	0.308	0.261	0.255	0.206
Difference-in-Hansen	0.470	0.693	0.822	0.797	0.810

*, ** and *** denote significance at the 10%, 5% and 1% level, respectively.

Table 7

Investment-cash flow sensitivity and value of insider trading – controlling for measures of financing needs

This table presents the results for the GMM-system regressions for the investment-cash flow equation for the sub-panel of firm-years with positive cash flow. We use various value-based measures of insider trading interacted with cash flow. All variables are defined in Table 1. Figures in brackets are *p*-values based on the Windmeijer bias-corrected (WC) robust two-step GMM estimator. Year dummies are included in all specifications. m_1 and m_2 are the tests for the absence of first-order and second-order correlation in the residuals, respectively. The *p*-values are reported for the Hansen *J* test of over-identification under the null that all instruments are valid and the Difference-in-Hansen test of exogeneity under the null that instruments used for the equations in levels are exogenous.

	(1)	(2)	(3)	(4)	(5)	(6)
I_{t-1}	0.671	0.615	0.653	0.599	0.656	0.572
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
CF	0.101	0.081	0.152	0.073	0.125	0.071
	(0.328)	(0.455)	(0.143)	(0.502)	(0.258)	(0.508)
Q	-0.005	-0.007	-0.005	-0.005	-0.007	-0.004
	(0.050)**	(0.009)***	(0.073)**	(0.132)	(0.018)**	(0.131)
CF×D_Q	0.026	-0.020	-0.019	-0.042	0.016	-0.008
	(0.669)	(0.707)	(0.747)	(0.477)	(0.798)	(0.874)
CF×D_R&D	-0.069	-0.073	-0.081	-0.080	-0.076	-0.070
	(0.102)	(0.072)*	(0.054)*	(0.057)*	(0.072)*	(0.066)*
CF×SIZE	0.003	0.012	0.003	0.013	0.003	0.012
	(0.741)	(0.218)	(0.709)	(0.154)	(0.779)	(0.153)
CF×D_Dividend_Cut_Omission	0.059					
	(0.252)					
CF×D_Equity_Issue		-0.020				
		(0.666)				
CF×D_Coverage_less_than_2			-0.074			
			(0.481)			
CF×D_Receivership_Liquidation				0.055		
				(0.715)		
CF×D_Financing_Needs					0.063	
					(0.309)	
CF×KZ						0.038
						(0.019)**
CF×TOTAL_ VALUE	0.002	0.004	0.003	0.005	0.003	0.005
	(0.571)	(0.230)	(0.301)	(0.098)*	(0.232)	(0.121)
CF×NETPURCHASES_ VALUE	-0.082	-0.084	-0.077	-0.086	-0.091	-0.070
	(0.006)***	(0.010)**	(0.013)**	(0.013)**	(0.006)***	(0.041)**
Constant	0.009	0.009	0.008	0.002	0.009	0.006
	(0.219)	(0.204)	(0.305)	(0.779)	(0.198)	(0.403)
N	9,423	9,423	9,423	9,423	9,423	9,423
m_1	0.000	0.000	0.000	0.000	0.000	0.000
m_2	0.576	0.640	0.581	0.675	0.585	0.733
Hansen J	0.154	0.515	0.259	0.342	0.318	0.300
Difference-in-Hansen	0.757	0.851	0.504	0.874	0.749	0.684

*, ** and *** denote significance at the 10%, 5% and 1% level, respectively.